(19) European Patent Office
Office européen des brevets

(11) EP 1 042 234 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
31.07.2002 Bulletin 2002/31

(21) Application number: 98964153.5

(22) Date of filing: 16.12.1998

(51) Int Cl.7: C02F 1/68, C02F 1/76, B01F 1/00

(86) International application number:
PCT/US98/27123

(87) International publication number:
WO 99/31018 (24.06.1999 Gazette 1999/25)

(54) CHEMICAL FEEDER

ZUFÜHREINRICHTUNG FÜR CHEMISCHE SUBSTANZEN

DOSEURS DE REACTIFS

(84) Designated Contracting States:
DE FR GB

(30) Priority: 17.12.1997 US 69941 P
25.11.1998 US 199311

(43) Date of publication of application:
11.10.2000 Bulletin 2000/41

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Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention is directed generally to chemical feeders. In particular, the present invention is directed to automatic chemical feeders useful for preparing a liquid solution of a chemical material, e.g., a sanitizing chemical, and dispensing such solution at or to a location, e.g., a large body of water, where it is to be used. More particularly, the present invention is directed to a chemical feeder that automatically dispenses controlled amounts of an aqueous solution of calcium hypochlorite in a reliable, efficient and cost effective manner for treatment of water systems, e.g., water treatment plants, potable water supplies, water for industrial or process usage, waste water systems, water systems for cooling towers, run-off water, swimming pools, hot tubs and the like.

[0002] Chemical feeders for producing aqueous solutions of water treating agents are well known and have been utilized with processes for the disinfection of effluent from sewage treatment plants, for the chlorination of water in swimming pools and hot tubs, and for the delivery of other watersoluble chemicals to aqueous streams and water systems. Chemical feeders designed for the disinfection of effluent from sewage treatment plants have been designed to overcome the drawbacks of previous chlorine treatment systems, which required extensive daily attention by operators in order to achieve acceptable disinfection of the sewage plant effluent. Chlorine and other sanitizing chemicals are used in swimming pool and hot tub applications to control the growth of algae and other organisms in the water. The concentration of the sanitizing chemical in a body of water, e.g., a swimming pool, must be kept between the concentration level that is effective to eliminate algae and other objectionable organisms and below the concentration level that is harmful to the user. Consequently, chemical feeders used in treating bodies of water, e.g., swimming pools and hot tubs, have been designed to alleviate the shortcomings, e.g., wide variations in treating agent concentration, that typically accompany manual treatment, e.g., manual chlorination and manual chemical addition. Examples of existing chemical feeders for treating aqueous streams and / or bodies of water, e.g., sewage effluent, pools and hot tubs, can be found in United States Patent Nos. 3,595,786; 3,595,395; 4,584,106; 4,732,689; and 4,759,907.

[0003] One difficulty associated with some of these prior art designs is that they can result in the build up of pressurized air within the chemical feeder, which may lead to potentially dangerous conditions in the event the chemical feeder ruptures or is inadvertently opened while pressurized. An additional disadvantage of some of the prior art chemical feeders is a build up of chemical residue within portions of the chemical feeder. A build up of chemical residue can detrimentally affect the chemical delivery rate of the feeder, eventually requiring it to be taken off-line and cleaned. These difficulties may significantly increase the amount of maintenance required for operation of a chemical feeder.

[0004] It would be desirable to develop a new and useful chemical feeder that overcomes the aforementioned drawbacks of the prior art while maintaining a substantially constant delivery rate of chemical treating agent. It would also be particularly desirable that such a new chemical feeder be easy to use, e.g., easy to recharge with chemical treating agent, and safe to operate, in particular, with regard to minimizing substantially the build up of pressurized air therein.

[0005] In accordance with the present invention, there is provided a chemical feeder comprising the features as defined in Claim 1.

[0006] In another embodiment of the present invention, the inlet for supplying liquid to the chamber of the housing is located in a sidewall of the housing and provides a tangential, cyclonic flow of liquid within the chamber.

[0007] In a further embodiment of the present invention the overflow standpipe is positioned along a longitudinal centerline of the housing, which maintains the chamber substantially flooded with liquid during operation of the feeder.

[0008] The features that characterize the present invention are pointed out with particularity in the claims which are annexed to and form a part of this disclosure. These and other features of the invention, its operating advantages and the specific objects obtained by its use will be more fully understood from the following detailed description and the accompanying drawings in which preferred embodiments of the invention are illustrated and described, and in which like reference characters designate corresponding parts.

[0009] Other than in the operating examples, or where otherwise indicated, all numbers and values, such as those expressing quantities of ingredients and reaction conditions, used in the specification and claims are to be understood as modified in all instances by the term "about."

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a partially exploded, partially cut away perspective view of a chemical feeder according to the present invention;

Figure 2 is a perspective view of a canister bundle used in the chemical feeder illustrated in Figure 1;

Figure 3 is a plan view schematically illustrating the flow in the chemical feeder illustrated in Figure 1; and

Figures 4a through 4e illustrate charts summarizing experimental results utilizing the chemical feeder of the present invention and comparative chemical feeders in various operating conditions and configurations.

DETAILED DESCRIPTION OF THE INVENTION

[0011] A chemical feeder according to the present invention is illustrated in Figure 1. The chemical feeder 2 has sidewall 12 having an interior surface 50 and an exterior surface 53, and a base plate 14 having an interior surface 56. Sidewall 12 and base plate 14 together form a housing having a chamber 62 therein. More specifically, interior surface 50 of sidewall 12 and interior surface 56 of base plate 14 together define chamber 62. In a preferred embodiment, sidewall 12 is substantially cylindrical and constructed to have a height of 24 inches (61 cm) and an external diameter of 12 inches (30.5 cm). Base plate 14 is attached to interior surface 50 of sidewall 12, preferably at a height above the bottom end of sidewall 12 which is sufficient to accommodate an outlet fitting 16. In a preferred embodiment, the fitting 16 is positioned 4 inches (10 cm) above the bottom end of sidewall 12. Base plate 14 has a diameter substantially matching the inner diameter of sidewall 12, which diameter is, in a preferred embodiment, for example, 11 inches (28 cm).

[0012] The specific size and shape of sidewall 12 and base plate 14 can be varied to accommodate the specific implementation of chemical feeder 2, as is known to those of ordinary skill in the art. As shown, the interior surface 50 and exterior surface 53 of sidewall 12 are substantially parallel and substantially cylindrical, which together with substantially circular base plate 14 forms a substantially cylindrical housing for chemical feeder 2 further having a substantially cylindrical chamber 62 therein. However, the housing of chemical feeder 2 may be of any appropriate geometric shape, e.g., cylindrical, elliptical, spherical or square shaped. The shape of base plate 14 will follow the selected shape of interior surface 50 of sidewall 12. The specific dimensions set forth in this specification are for illustrative purposes only.

[0013] Outlet fitting 16 is attached to sidewall 12 at a side outlet opening 18, and extends within the housing to overflow standpipe 20. Overflow standpipe 20 extends through base 14 along the longitudinal centerline of the housing of chemical feeder 2, i.e., substantially parallel with sidewall 12, to substantially the top of chamber 62. An overflow standpipe opening 22 is formed at the upper end of overflow standpipe 20. Overflow standpipe opening 22 is in fluid communication with side outlet opening 18 by means of standpipe 20 and outlet fitting 16. The level of overflow standpipe opening 22 defines the level of fluid in chamber 62. Overflow standpipe opening 22 is preferably positioned in proximity to the top of chamber 62 to maintain the chamber substantially flooded during operation. This configuration minimizes substantially the accumulation of pressurized air in chemical feeder 2 during operation.

[0014] A tangential inlet 24 is formed through both the exterior 53 and interior 50 surfaces of sidewall 12, and in a preferred embodiment of the present invention is positioned 1 inch (2.5 cm) above base plate 14. Tangential inlet 24 is used to introduce liquid into chamber 62 in a direction substantially tangential to the interior surface 50 of sidewall 12. Preferably, inlet 24 is located in proximity to the lower portion of canisters 34 so that the introduced liquid contacts the bottom and lower sections of the canisters shortly after being introduced into chamber 62.

[0015] A lid 26 is provided to engage and close the upper end of the housing of feeder 2 with an intermediate gasket 28 providing a tight sealing closure for chamber 62. A plurality of bolt holes 29 extend through lid 26, gasket 28 and an upper clamping ring 27 to allow lid 26 to be securely attached to the housing by a plurality of bolts (not shown). A wide variety of other lid configurations may also be utilized provided they maintain a sealed environment for chamber 62. For example, latches may be used to secure lid 26 to clamping ring 27; lid 26 may be threaded and screwed into or onto the upper portion of sidewalls 12, which would be constructed with appropriately located matching threads; or the lid may be secured by any of several other art-recognized methods by which lids may be attached to a housing. It is contemplated that lid 26 may be eliminated if chemical feeder 2 is operated in the absence of a positive pressure difference between chamber 62 and the environment outside of the chamber.

[0016] Chemical feeder 2 additionally includes a canister bundle 5, illustrated in greater detail in Figure 2. Canister bundle 5 includes a circular support plate 32 supporting a plurality of canisters 34. Support plate 32 includes canister receiving holes 36, each adapted to receive one canister 34 therethrough. Preferably, the canisters are sized to receive tablets of solid chemical material, i.e., solid chemical treating agent, and will be referred to hereinafter as tablet canisters.

[0017] Support plate 32 additionally includes one or more fluid flow holes 38, preferably four as shown in Figure 1, positioned between tablet canister receiving holes 36 allowing fluid flow therethrough, as will be described hereinafter. Support plate 32 additionally includes a central hole 40 for receiving standpipe 20 therethrough, as shown in Figure 1. Support plate 32 can rest upon support means projecting from the sidewall into the chamber, e.g., an annular ridge or series of stops (not shown) attached to or formed on interior surface 50 of sidewall 12, and has a diameter substantially the same as the interior diameter of sidewall 12. Support plate 32 is preferably slidably received within chamber 62 along interior surface 50 for easy assembly and disassembly.

[0018] While four canisters are shown, more or less, e.g., five or three, canisters may be used. The shape of the canisters and support plate may also vary - the support plate shape depending on the interior shape of chamber 62. The size, e.g., diameter, of the canisters may vary and will depend on, for example, the size of chamber 62, e.g., its diameter and height, and the size and shape of the chemical treating agent placed therein, e.g., tablet diameter. Similarly, more or less fluid flow

holes 38 may be present.

[0019] Tablet canisters 34 preferably have a substantially constant diameter along their length to be slidably received within tablet canister receiving holes 36 and include an enlarged lip 42 either at or in proximity to the upper end of each canister. Lip 42 is of a diameter larger than that of tablet canister receiving holes 36 and rests against an upper surface 59 of support plate 32 to support tablet canister 34, as schematically illustrated in Figures 1 and 2. Optionally, the top of each canister may be covered with a lid, e.g., lip 42 may also be part of a screw on lid (not shown).

[0020] The interior of each tablet canister 34 is dimensioned preferably to receive tablets of solid chemical treating agent. In a preferred embodiment, the tablets comprise calcium hypochlorite and are generally 3.13 inch (8 cm) in diameter and about 1.25 inch (3 cm) thick. The bottom end of tablet canister 34 is constructed to support the tablets received therein. While the bottom end of tablet canister 34 may be solid, i.e., closed, it is preferred that one or more holes be present therein. In a particularly preferred embodiment of the present invention, the bottom end of canister 34 is closed except for seven 0.75 inch (2 cm) holes 44 evenly spaced apart in an hexagonal array with one hole 44 in the center of the hexagon. Additionally, six rectangular holes 46 are evenly spaced around the lower end or section of the vertical wall of tablet canister 34 with each rectangular hole 46 being approximately 1.13 inch (2.9 cm) wide by 1.375 inch (3.5 cm) tall.

[0021] Each tablet canister 34 is arranged to receive a stack of appropriately sized tablets and is designed so that the rectangular holes 46 expose the lowermost tablet(s) to chamber 62. The number, size, shape and location of the aforedescribed openings in canister 34 may vary, depending on the size of the feeder, the delivery rate and concentration of the solution produced by the feeder, and other such criteria.

[0022] Figure 3 illustrates the cyclonic flow of liquid within chamber 62 when substantially flooded. Cyclonic flow is introduced through tangential inlet 24, as represented by arrow 65, and provides a turbulent flow past the exposed lowermost tablet(s) in each tablet canister 34. The cyclonic flow continues up through chamber 62, around and about the exterior of canisters 34 and out of the substantially flooded chamber 62 through overflow standpipe outlet opening 22. The cyclonic flow provides a self-cleaning action to the chamber of chemical feeder 2 of the present invention. The cyclonic flow pattern, schematically illustrated in Figure 3 by bold arcuate arrow lines 68, minimizes, and preferably prevents substantially, the build up of chemical residue within chemical feeder 2. As discussed above, tablet canisters 34 are designed to preferably only expose the exterior, e.g., bottom and sides, of the lowermost solid chemical treating agent, e.g., tablets, within tablet canister 34 to the turbulent flow introduced by tangential inlet 24.

[0023] Chemical feeder 2 can be connected to a source of fluid, e.g., a pressurized aqueous stream, through tangential inlet 24, by means of a suitable conduit, not shown. Further, outlet fitting 16 may be connected to a suitable conduit, not shown, through which a liquid stream having chemical treating agent dissolved therein may be transported to a point of use, e.g., a swimming pool or reservoir. Inlet 24 and outlet fitting 16 may be provided with threaded portions or other conventional connecting means, e.g., quick-release fittings, to provide connections to associated conduits.

[0024] In an embodiment of the operation of chemical feeder 2, canisters 34 are filled with tablets of solid chemical treating agent and the canisters placed in support plate 32. The entire assembled canister bundle 5 is inserted within chamber 62 such that overflow standpipe 20 extends through central hole 40 of support plate 32. Lid 26 is attached to clamping ring 27, and tangential inlet 24 connected to a source of liquid, e.g., water. The liquid is introduced tangentially, and preferably under pressure, into chamber 62, thereby creating cyclonic flow of the liquid and causing the liquid to contact the exposed lowermost tablet(s) within canister(s) 34. The tablets are dissolved in the liquid which rises within chamber 62 and passes through flow holes 38 onto surface 59 of canister support plate 32. A liquid solution of dissolved chemical treating agent flows into overflow standpipe 20 through overflow standpipe opening 22, and from there exits the feeder through outlet opening 18 from whence it can be forwarded to a point of use, e.g., a swimming pool, through a suitable conduit, not shown.

[0025] Chemical feeder 2 and its various components may be fabricated from any suitable material or combination of materials that are chemically and corrosion resistant to the solid chemical treating agent used, examples of which include, but are not limited to, polyethylene, ABS (acrylonitrile-butadiene-styrene resin), fiberglass reinforced resins, polystyrene, polypropylene, poly(vinyl chloride), chlorinated poly(vinyl chloride) or any other appropriate material(s) that is chemically resistant to the solid chemical being dispensed, e.g., a sanitizing agent such as calcium hypochlorite. Other materials such as stainless steel may also be used, but the use of such material would result in a substantial increase in cost. In a preferred embodiment, the feeder is fabricated from poly(vinyl chloride) (PVC), which is generally chemically resistant to water sanitizing chemicals, such as calcium hypochlorite. Plastic parts of the feeder may be fabricated by art-recognized methods including, for example, injection or rotation molding.

[0026] When constructed of plastic resin material, the various parts of the feeder may be joined by solvent or heat welding or by threading. The inlet and outlet conduits may also be joined to the feeder by the use of conventional bulkhead fittings. If a metal, such as stainless steel is used, conventional welding of the parts may be used to fabricate the feeder. Alternatively, the various parts of the feeder may be joined by conventional

threaded bolts and appropriate gasketing to insure that the feeder is sealed, e.g., water-tight.

[0027] The solid chemical material, or treating agent, used with the chemical feeder of the present invention may be any chemical that is solid at ambient, i.e., standard, conditions of temperature and pressure (STP), which may be formed into pellets or tablets, and which is readily soluble in a flowing liquid, e.g., water, at STP conditions. Examples of such chemicals are sanitizing agents, e.g., chemicals that sanitize water, such as for example, calcium hypochlorite, bromo-chloro hydantoin, dichlorohydantoin and chloroisocyanurates; dechlorination agents such as sodium sulfite, sodium metabisulfite, sodium bisulfite, sodium thiosulfate, sodium hydrosulfide (NaSH), and sodium sulfide (Na_2S); and pH control agents such as sodium bisulfate, citric acid, sodium carbonate, sodium bicarbonate and quaternary ammonium compounds, some of which may be used also as algaecides.

[0028] It will be readily appreciated by those skilled in the art that the feeder of the present invention can be integrated into liquid, e.g., water, treatment facilities by appropriate piping connected with tangential inlet 24 and outlet fitting 16. The chemical feeder may be integrated into, for example: a single pass system, e.g., an aqueous stream used to sanitize the surface of an article, e.g., vegetables such as potatoes; or a closed loop system, e.g., a swimming pool. In one embodiment, tangential inlet 24 is connected to a by-pass line off of a main liquid, e.g., water, conduit by appropriate additional conduits, thereby providing a source of liquid for treatment. The liquid solution containing chemical treating agent removed through outlet fitting 16 is forwarded through appropriate conduits and introduced back into the main liquid conduit at a convenient point downstream of the by-pass line connection. In another embodiment, if the fluid flow in the main liquid conduit can be handled directly by the feeder, the feeder may be connected directly, i.e., in-line, with the main liquid conduit.

[0029] It is anticipated that the bolted lid 26 and gasket 28 arrangement can be replaced with other types of known connections for sealingly engaging a lid onto the cylindrical base of a housing. Such housing assemblies are commonly utilized in pool filter arrangements. Additionally, the location of the inlet and outlet connections to the chemical feeder may be varied provided that the outlet from chamber 62 maintains a substantially flooded arrangement therein. The positioning of standpipe 20 along the centerline of chamber 62 allows for minimal interruption of the cyclonic flow of the liquid passing through chemical feeder 2. However, it is understood that standpipe 20 may be moved to a different position or different orientation relative to sidewall 12, e.g., closer to interior surface 50. These embodiments demonstrate that a wide variety of changes may be made to chemical feeder 2 of the present invention without significantly affecting the operation thereof.

[0030] The present invention is more particularly described in the following examples, which are intended to be illustrative only. Unless otherwise specified, all parts and percentages are by weight.

EXAMPLE 1

[0031] This example represents an advantageous and successful operation of a chemical feeder according to the present invention. A chemical feeder, as represented in Figure 1, was connected through a closed loop to a pool containing about 10,000 gals (38,000 liters) of water, by means of suitable conduits and a pump. An inlet conduit was connected to tangential inlet 24 and included a flow meter and an inlet control valve to control the water flow rate together with a sample valve so that the incoming water could be sampled and analyzed. Outlet fitting 16 was fitted with an outlet valve attached to an appropriate conduit to return treated water to the pool. By coordinating the adjustment of both the inlet and outlet valves, it was possible to control the operating pressure within chamber 62 of the chemical feeder.

[0032] Each of the four tablet canisters 34 was loaded with six calcium hypochlorite tablets, each 3.5 inches (9 cm) in diameter by 1.25 inches (3 cm) thick weighing about two-thirds of a pound (0.3 kg) and containing about 68 % available chlorine by weight, available commercially from PPG Industries, Inc. under the designation PPG 3" Calcium Hypochlorite Tablets. Each of the four loaded tablet canisters were inserted into one of the four tablet canister receiving holes 36 of support plate 32, and the associated canister bundle 5 was placed into chamber 62, followed by bolting lid 26 and gasket 28 into place. Water flow to the chemical feeder was adjusted to 13 gallons per minute (GPM) (49 liters/min LPM) and the pressure in the feeder was adjusted to 4 pounds per square inch (27.6 kPa), i.e., relative to ambient. Periodically, samples were taken separately from the influent and effluent water and analyzed for available chlorine by iodometric titration. The chlorine delivery rate at any given point in time was determined by calculating the difference in available chlorine concentration between the effluent and influent water and multiplying this value by the water flow rate through the chemical feeder.

[0033] The chemical feeder was operated for six hours per day, i.e., six hours of flow-through operation, and allowed to rest, i.e., stand full of water with the inlet and outlet valves both closed, during the remainder of the day. These operating conditions were intended to simulate typical pool use in which either the recirculation pump is off for much of the day or when an oxidation-reduction potential (ORP) controller cuts off the flow of water through the chemical feeder when the chlorine demand has been satisfied. During the rest periods, the available chlorine level within the pool of water was separately maintained below 10 parts per million parts of water (ppm) by measured additions of hydrogen perox-

ide.

[0034] Figure 4a is a graphical representation of the results obtained from an evaluation of the chlorine delivery rate of the chemical feeder operated as described for six hours a day over a total period of four days. Each subsequent period of flow-through operation is separated from the previous period by breaks in the plotted lines in Figures 4a - 4e. In Figures 4a - 4e the chlorine delivery rate, in units of pounds of chlorine per hour (Lb./Hr.), is plotted versus elapsed flow time, i.e., flow-through operation, in units of hours. Also in Figures 4a - 4e, the time that the feeder was allowed to rest, for example between the first and second periods of flow-through operation in Figure 4a, is indicated by the phrase "Flow off 18 hours."

[0035] As illustrated in Figure 4a, the first six hour period of flow-through operation resulted in an initially high chlorine delivery rate which dropped rapidly over the initial three hours and then began to level off during the final three hours of operation. During the second and third periods of six hour flow-through operation, the chlorine delivery rate was relatively stable at from about 0.2 Lb./Hr. (90 grams/Hr.) to 0.3 Lb./Hr. (136 grams/Hr.). It was not until the final three hours of the fourth period of six hour flow-through operation that the rate of chlorine delivery was observed to drop to nearly zero, due to substantial depletion of the calcium hypochlorite tablets initially loaded into tablet canisters 34.

EXAMPLE 2

[0036] This example demonstrates that a constant chlorine delivery rate can be adjusted by adjusting the water flow rate through a chemical feeder according to the present invention. The chemical feeder of Example 1 was operated substantially as described, except that the water flow rate was set at 12 GPM (45 LPM) for the first, second and fourth periods of flow-through operation and 14 GPM (53 LPM) for the third period.

[0037] With regard to the rate of chlorine delivery, the same general trends were observed in Example 2 as were observed in Example 1, see Figure 4b. With lower and higher flow rates through the chemical feeder, the chlorine delivery rate was observed to be steady, i.e., plateaued, and correspondingly lower and higher, respectively. More specifically, with a flow rate of 12 GPM the chlorine delivery rate was observed to be steady at about 0.2 Lb./Hr. (90 grams/Hr.), during the second and fourth periods of flow-through operation. With the higher flow rate of 14 GPM, the chlorine delivery rate was observed to be steady at about 0.4 Lb./Hr. (181 grams/Hr.), during the third period of flow-through operation.

EXAMPLE 3

[0038] This is a comparative example involving the operation of a chemical feeder similar to that of Example 1 but in which a sieve plate is present in place of the tablet canisters 34. with reference to Figure 1, a sieve plate (not shown) having a plurality of 1.25 inch (3.2 cm) diameter holes and a centrally located 1.5 inch (3.8 cm) diameter hole for accommodation of standpipe 20 was supported within chamber 62 on a welded ring (not shown) at a height of 1 inch (2.5 cm) above tangential inlet 24. Upon the sieve plate were randomly placed 24 PPG 3" Calcium Hypochlorite Tablets. The chemical feeder of Example 3 was operated substantially as described in Example 1 with a water flow rate of 12 GPM (49 LPM).

[0039] The results of Example 3 are summarized in Figure 4c, which graphically illustrates that the initial chlorine delivery rate was higher at 1.4 Lb./Hr. (635 grams/Hr.) than that observed in Example 1, which was about 1.0 Lb./Hr. (454 grams/Hr.), and did not reach a steady state until the third period of flow-through operation. In addition, the calcium hypochlorite tablets initially placed on the sieve plate were observed to have been substantially depleted by the end of the third six hour period of flow-through operation.

EXAMPLE 4

[0040] This is a comparative example in which a chemical feeder similar to that of Example 1 was operated without cyclonic water flow by reversing the flow of water through the feeder. Prior to bolting down lid 26, the feeder was initially filled with water. During flow-through operation, water was introduced into the feeder through outlet opening 18, passing through outlet fitting 16 and standpipe 20, and emerging from standpipe opening 22 into the flooded chamber 62. Correspondingly, water was removed from the feeder through tangential inlet 24. Lid 26 was transparent, allowing for a visual determination of the water level within the feeder, which was observed to remain constant and full throughout the course of the experiment. Otherwise, the chemical feeder of Example 4 was operated substantially as described in Example 1 with a water flow rate of 12 GPM (49 LMP).

[0041] The results of Example 4 are summarized in Figure 4d, which graphically illustrates that the chlorine delivery rate dropped steadily over the whole of the first six hour period of flow-through operation, and did not become steady until the third period of flow-through operation. In addition, the calcium hypochlorite tablets initially loaded into tablet canisters 34 were observed to have been substantially depleted by the end of the third six hour period of flow-through operation.

EXAMPLE 5

[0042] This is a comparative example in which a chemical feeder similar to that of Example 3 was operated without cyclonic flow, in addition to the absence of tablet canisters 34. with general reference to Figure 1, chamber 62 of the chemical feeder used in this example

had an inner diameter of 11.3 inches (28.7 cm) and a height of 14 inches (35.6 cm). A sieve plate (not shown) holding 24 randomly placed PPG 3" Calcium Hypochlorite Tablets was positioned within chamber 62 at a height of 3 inches (7.6 cm) above base plate 14. The sieve plate had a plurality of 1.25 inch (3.2 cm) diameter holes, and one 1.5 inch (3.8 cm) diameter hole for accommodation of standpipe 20 located 2.5 inches (6.4 cm) from interior surface 50 of sidewall 12. The tangential inlet 24 was replaced with a radial inlet (not shown) positioned 2 inches (5.1 cm) above base plate 14, through which fluid was introduced into chamber 62. Fluid was removed from chamber 62 through an outlet approximating side outlet 18 at a rate of 8 GPM (30 LPM). The feeder was initially filled with water prior to sealing. Otherwise, the chemical feeder of Example 5 was operated under the conditions described in Example 1.

[0043] The results of Example 5 are summarized in Figure 4e, which graphically illustrates that the chlorine delivery race was not observed to reach a steady state throughout the whole of the experiment. In addition, the chlorine delivery rate was observed to drop to nearly zero by the third hour of the third period of flow-through operation due to substantial depletion of the calcium hypochlorite tablets initially placed on the sieve plate.

[0044] The above Examples 1 and 2 and comparative Examples 3, 4 and 5 demonstrate the effectiveness of the chemical feeder of the present invention in delivering a chemical treating agent, e.g., chlorine, to a liquid stream at a relatively constant and controllable rate. In particular, the above examples demonstrate the advantage of combining within a chemical feeder according to the present invention the elements of: (a) tablet canisters having a plurality of perforations in their lower portions which serve to expose the lower most tablets loaded therein to; (b) a cyclonic flow of water provided by tangential inlet 24. The above examples further demonstrate the advantage of operating the chemical feeder of the present invention in a substantially flooded condition, which substantially eliminates the accumulation of pressurized air within chamber 62, thereby providing a significant safety advantage.

[0045] The present invention has been described with reference to specific details of particular embodiments thereof. It is not intended that such details be regarded as limitations upon the scope of the invention except insofar as and to the extent that they are included in the accompanying claims.

Claims

1. A chemical feeder (2) comprising:

   (a) a housing having a chamber (62) therein;
   (b) at least one canister (34) for holding solid chemical material supported within said chamber (62), said canister (34) having a plurality of perforations (44,46) in its lower portion,
   (c) at least one inlet (24) in said housing extending into said chamber (62), said inlet (24) being situated such that liquid introduced into said chamber (62) through said inlet (24) is in spaced relationship with said canister (34), said inlet (24) providing a tangential cyclonic flow of liquid within said chamber (62), said perforations (44,46) in said canister (34) being such as to expose only the lower portion of the solid chemical material contained within said canister (34) to liquid introduced into said chamber (62), and
   (d) at least one outlet (16,18) in said housing through which liquid having chemical material dissolved therein flows out of said chamber (62), said outlet (16,18) including an overflow standpipe (20) positioned to maintain said chamber (62) substantially flooded with liquid during operation of the feeder (2).

2. The chemical feeder (2) of claim 1 wherein said inlet (24) is in a sidewall (12) of said housing.

3. The chemical feeder (2) of claim 2 wherein said sidewall (12) is substantially cyclindrical.

4. The chemical feeder (2) of claim 2 or 3 further comprising a base plate (14) attached to said sidewalls (12) of said housing and forming a lower end of said chamber (62), wherein the interior surfaces (56) of both of said sidewalls (12) and said base plate (14) together define said chamber (62) of said housing.

5. The chemical feeder (2) of claim 4 wherein said overflow standpipe (20) extends through said base plate (14).

6. The chemical feeder (2) of any of claims 1 to 5 wherein said overflow standpipe (20) is positioned along a longitudinal centerline of said housing.

7. The chemical feeder (2) of any of claims 1 to 6 further comprising a lid (26) attached, especially reversibly attached, to said housing for sealing said chamber (62) from the outside environment.

8. The chemical feeder (2) of claim 7 wherein said lid (26) is reversibly attached to said housing.

9. The chemical feeder (2) of any of claims 1 to 8 wherein said canister (34) and/or said base plate (14) is substantially cylindrical.

10. The chemical feeder (2) of claim 9 wherein a plurality of canisters (34) are supported in said chamber (62).

11. The chemical feeder (2) of any of claims 1 to 10 wherein said solid chemical material is in the form of tablets, and said canister (34) has an open top for receiving said tablets therein.

12. The chemical feeder (2) of any of claims 1 to 11 further comprising a support plate (32) supporting said canister (34), said support plate (32), especially being slideably received in said chamber (62) of said housing.

13. The chemical feeder (2) of claim 12 wherein said support plate (32) has a plurality of openings (38) to permit the passage of liquid introduced into said chamber (62).

14. The chemical feeder (2) of any of claims 1 to 13 wherein each canister (34) has a solid lid, said support plate (32) has a diameter substantially the same as said chamber (62) and rests on support means projecting from said sidewalls (12).

15. The chemical feeder (2) of claim 14 wherein at least three canisters (34) are supported within said chamber (62), and that portion of said overflow standpipe (20) extending through said base plate (14) is connected to an outlet fitting (16).

Patentansprüche

1. Chemikalienzuführvorrichtung (2), enthaltend:

   (a) ein Gehäuse mit einer Kammer (62) darin;
   (b) zumindest ein Behältnis (34) zum Aufnehmen eines festen Chemikalienmaterials, gehalten innerhalb der Kammer (62), wobei das Behältnis (34) eine Vielzahl von Perforationen (44,46) in seinem unteren Abschnitt aufweist,
   (c) zumindest einen sich in die Kammer (62) erstreckenden Einlaß (24) in dem Gehäuse, wobei der Einlaß (24) so positioniert ist, dass in die Kammer (62) durch den Einlaß (24) eingebrachte Flüssigkeit sich mit Abstand zu dem Behältnis (34) befindet, wobei der Einlaß (24) eine tangentiale Zyklonströmung der Flüssigkeit innerhalb der Kammer (62) erzeugt, wobei die Perforationen (44,46) in dem Behältnis (34) so vorgesehen sind, dass lediglich der untere Abschnitt des festen, in dem Behältnis (34) enthaltenen Chemikalienmaterials der in die Kammer (62) eingebrachten Flüssigkeit ausgesetzt ist, und
   (d) zumindest einen Auslaß (16,18) in dem Gehäuse, durch den Flüssigkeit mit darin gelöstem Chemikalienmaterial aus der Kammer (62) herausfließt, wobei der Auslaß (16,18) einen Überlaufstutzen (20) enthält, angeordnet, um die Kammer (62) während des Betriebs der Zuführvorrichtung (2) im wesentlichen mit Flüssigkeit überflutet zu halten.

2. Chemikalienzuführvorrichtung (2) nach Anspruch 1, bei der der Einlaß (24) in einer Seitenwand (12) des Gehäuses vorgesehen ist.

3. Chemikalienzuführvorrichtung (2) nach Anspruch 2, bei der die Seitenwand (12) im wesentlichen zylindrisch ist.

4. Chemikalienzuführvorrichtung (2) nach Anspruch 2 oder 3, weiter enthaltend eine Basisplatte (14), die an den Seitenwänden (12) des Gehäuses angebracht ist und ein unteres Ende der Kammer (62) bildet, bei der die Innenflächen (56) beider Seitenwände (12) und die Basisplatte (14) zusammen die Kammer (62) bilden.

5. Chemikalienzuführvorrichtung (2) nach Anspruch 4, bei der der Überlaufstutzen (20) sich durch die Basisplatte (14) hindurch erstreckt.

6. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 5, bei der der Überlaufstutzen (20) entlang einer Längsmittellinie des Gehäuses angeordnet ist.

7. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 6, weiter enthaltend einen Deckel (26), der an dem Gehäuse zum Abdichten der Kammer (62) gegenüber der äußeren Umgebung angebracht, insbesondere lösbar angebracht ist.

8. Chemikalienzuführvorrichtung (2) nach Anspruch 7, bei der Deckel (26) lösbar an dem Gehäuse angebracht ist.

9. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 8, bei der das Behältnis (34) und/oder die Basisplatte (14) im wesentlichen zylindrisch ist.

10. Chemikalienzuführvorrichtung (2) nach Anspruch 9, bei der eine Mehrzahl von Behältnissen (34) in der Kammer (62) gehalten wird.

11. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 10, bei der das feste Chemikalienmaterial die Form von Tabletten aufweist und das Behältnis (34) ein offenes Oberteil zur Aufnahme der Tabletten darin aufweist.

12. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 11, weiter enthaltend eine Trägerplatte (32), die das Behältnis (34) trägt, wobei die Trägerplatte (32) insbesondere verschiebbar in der

Kammer (62) des Gehäuses aufgenommen ist.

13. Chemikalienzuführvorrichtung (2) nach Anspruch 12, bei der die Trägerplatte (32) eine Mehrzahl von Öffnungen (38) aufweist, um den Durchtritt von in die Kammer (62) eingebrachter Flüssigkeit zu ermöglichen.

14. Chemikalienzuführvorrichtung (2) nach einem der Ansprüche 1 bis 13, bei der jedes Behältnis (34) einen festen Deckel aufweist, die Trägerplatte (32) einen im wesentlichen gleichen Durchmesser wie die Kammer (62) aufweist und auf Trägereinrichtungen ruht, die von den Seitenwänden (12) vorstehen.

15. Chemikalienzuführvorrichtung (2) nach Anspruch 14, bei der zumindest drei Behältnisse (34) innerhalb der Kammer (62) getragen werden, und der Abschnitt des Überlaufstutzens (20), der sich durch die Basisplatte (14) hindurch erstreckt, mit einem Auslaßfitting (16) verbunden ist.

Revendications

1. Dispositif d'alimentation (2) en produit chimique, comprenant :

    (a) un boîtier comportant une chambre (62) en lui,
    (b) au moins un récipient (34) pour contenir une matière chimique solide supporté dans la chambre (62), le récipient (34) comportant une pluralité de perforations (44, 46) dans sa partie inférieure,
    (c) dans le boîtier, au moins une entrée (24) s'étendant dans ladite chambre (62), l'entrée (24) étant située de façon à ce que du liquide introduit dans la chambre (62) par l'entrée (24) soit en relation écartée avec le récipient (34), l'entrée (24) procurant un écoulement cyclonique tangentielle de liquide dans la chambre (62), les perforations (44, 46) dans le récipient (34) étant telles qu'elles exposent uniquement la partie inférieure de la matière chimique solide contenue dans le récipient (34) à du liquide introduit dans la chambre (62), et
    (d) au moins une sortie (16, 18), dans le boîtier, à travers laquelle du liquide qui comporte de la matière chimique qui y est dissoute s'écoule hors de la chambre (62), la sortie (16, 18) comprenant un tuyau dressé (20) de débordement, positionné pour conserver la chambre (62) sensiblement inondée de liquide pendant un fonctionnement du dispositif d'alimentation (2).

2. Dispositif d'alimentation en produit chimique (2) suivant la revendication 1, **caractérisé en ce que** l'entrée (24) est située dans une paroi latérale (12) du boîtier.

3. Dispositif d'alimentation en produit chimique (2) suivant la revendication 2, **caractérisé en ce que** la paroi latérale (12) est sensiblement cylindrique.

4. Dispositif d'alimentation en produit chimique (2) suivant la revendication 2 ou 3, **caractérisé en ce qu'**il comprend en outre une plaque de base (14) fixée aux parois latérales (12) du boîtier et formant une extrémité inférieure de la chambre (62), les surfaces intérieures (56) d'aussi bien les parois latérales (12) que de la plaque de base (14) déterminant ensemble la chambre (62) du boîtier.

5. Dispositif d'alimentation en produit chimique (2) suivant la revendication 4, **caractérisé en ce que** le tuyau dressé (20) de débordement s'étend à travers ladite plaque de base (14).

6. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 5, **caractérisé en ce que** le tuyau dressé (20) de débordement est positionné le long d'un axe longitudinal du boîtier.

7. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 6, **caractérisé en ce qu'**il comprend en outre un couvercle (26) fixé, en particulier fixé de manière réversible, au boîtier pour fermer la chambre (62) par rapport à l'environnement exteme.

8. Dispositif d'alimentation en produit chimique (2) suivant la revendication 7, **caractérisé en ce que** le couvercle (26) est fixé de manière réversible au boîtier.

9. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 8, **caractérisé en ce que** le récipient (34) et/ou la plaque de base (14) sont sensiblement cylindriques.

10. Dispositif d'alimentation en produit chimique (2) suivant la revendication 9, **caractérisé en ce qu'**une pluralité de récipients (34) sont supportés dans la chambre (62).

11. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 10, **caractérisé en ce que** la matière chimique solide se présente sous la forme de tablettes et **en ce que** le récipient (34) comporte un sommet ouvert pour y recevoir les tablettes.

12. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 11,

caractérisé en ce qu'il comprend en outre une plaque de support (32) qui supporte ledit récipient (34), la plaque de support (32), étant en particulier reçue de manière coulissante dans la chambre (62) du boîtier.

13. Dispositif d'alimentation en produit chimique (2) suivant la revendication 12, **caractérisé en ce que** la plaque de support (32) comporte une pluralité d'ouvertures (38) pour permettre le passage de liquide introduit dans la chambre (62).

14. Dispositif d'alimentation en produit chimique (2) suivant l'une quelconque des revendications 1 à 13, **caractérisé en ce que** chaque récipient (34) comporte un couvercle plein, et **en ce que** la plaque de support (32) a un diamètre sensiblement le même que celui de la chambre (62) et repose sur des moyens de support qui font saillie des parois latérales (12).

15. Dispositif d'alimentation en produit chimique (2) suivant la revendication 14, **caractérisé en ce qu'**au moins trois récipients (34) sont supportés dans ladite chambre (62) et **en ce qu'**une partie du tuyau dressé de débordement (20) qui s'étend à travers la plaque de base (14) est connectée à un raccord de sortie (16).

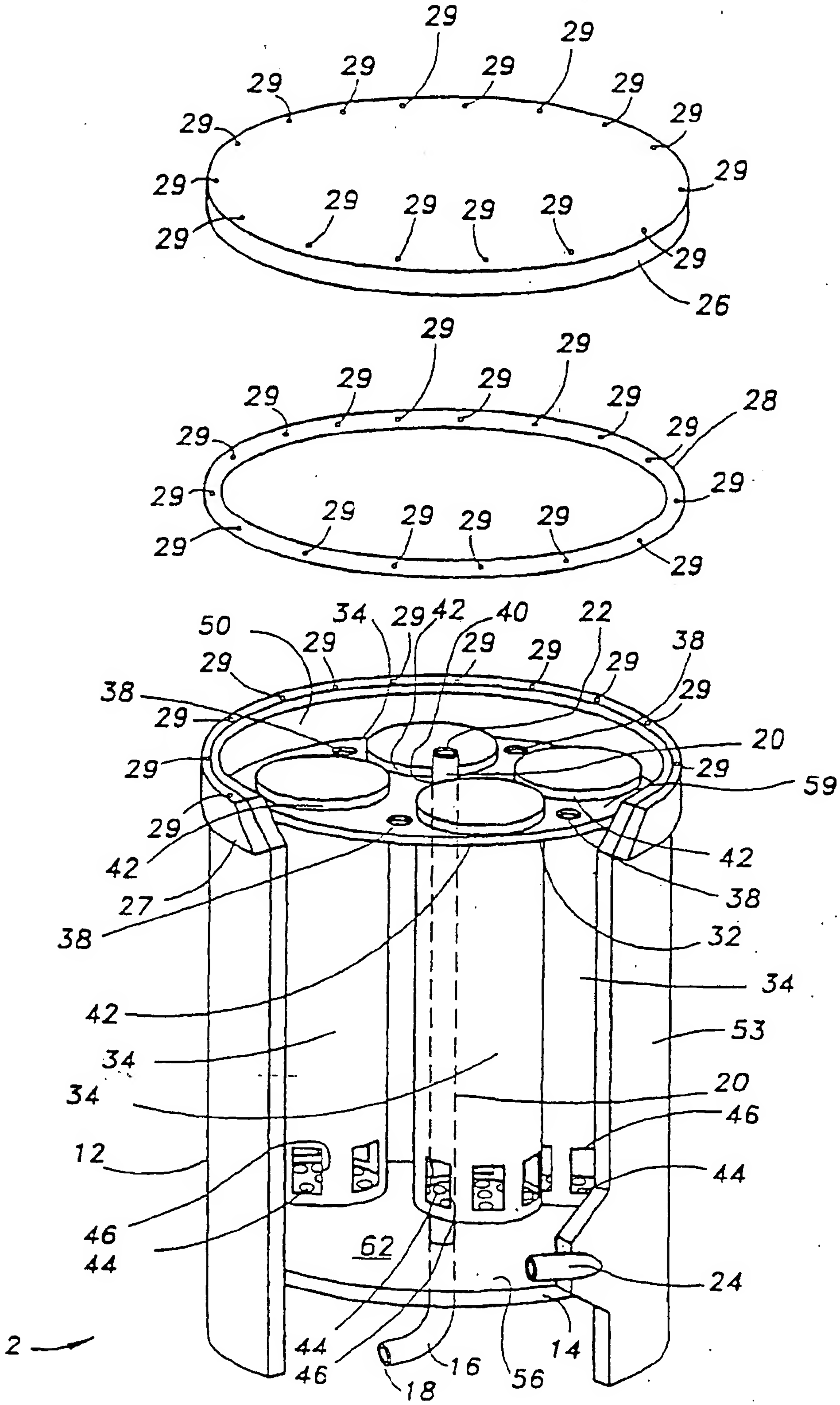

Figure 1

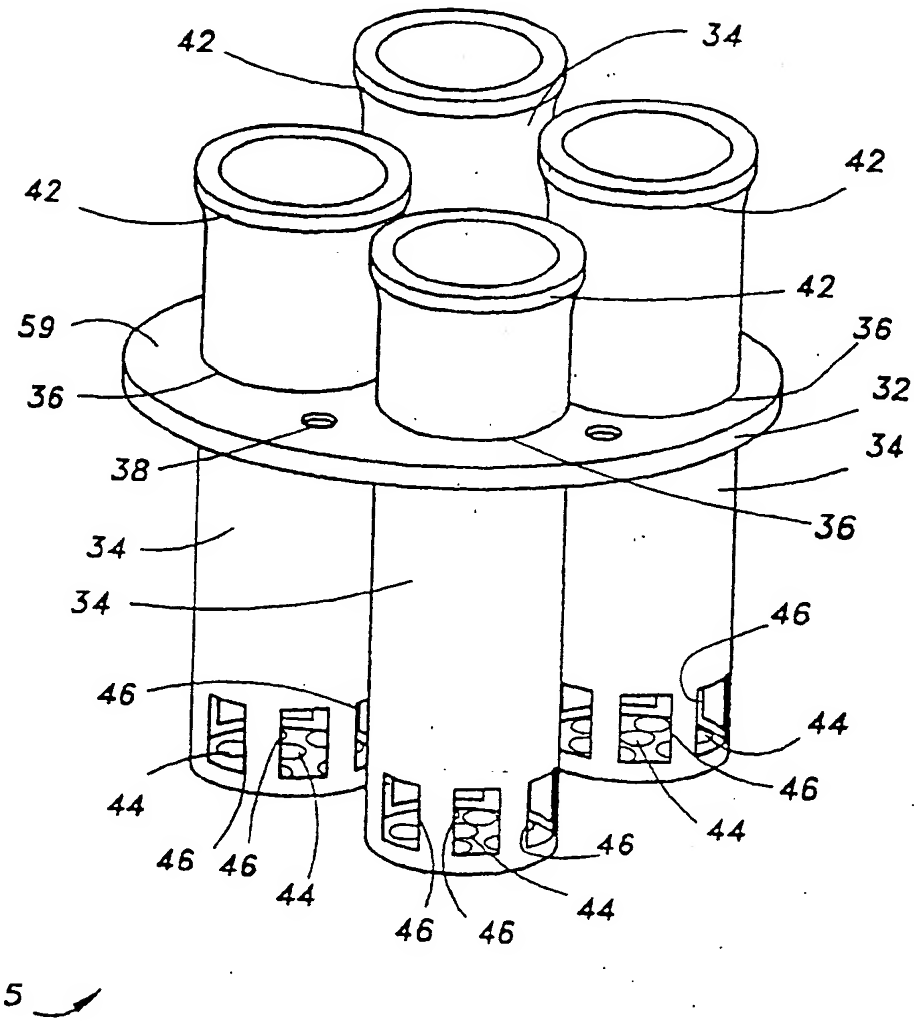
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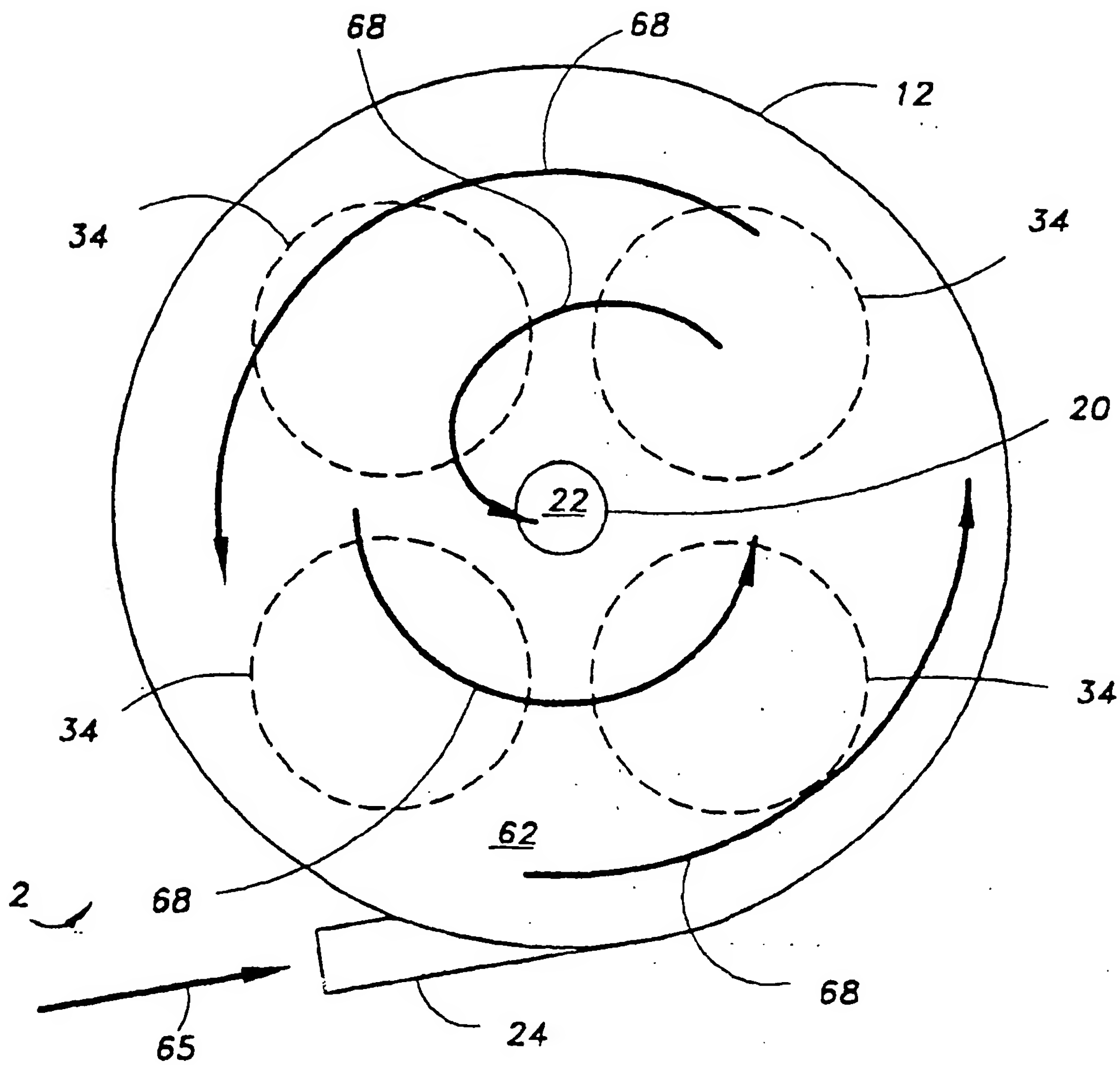
Figure 2



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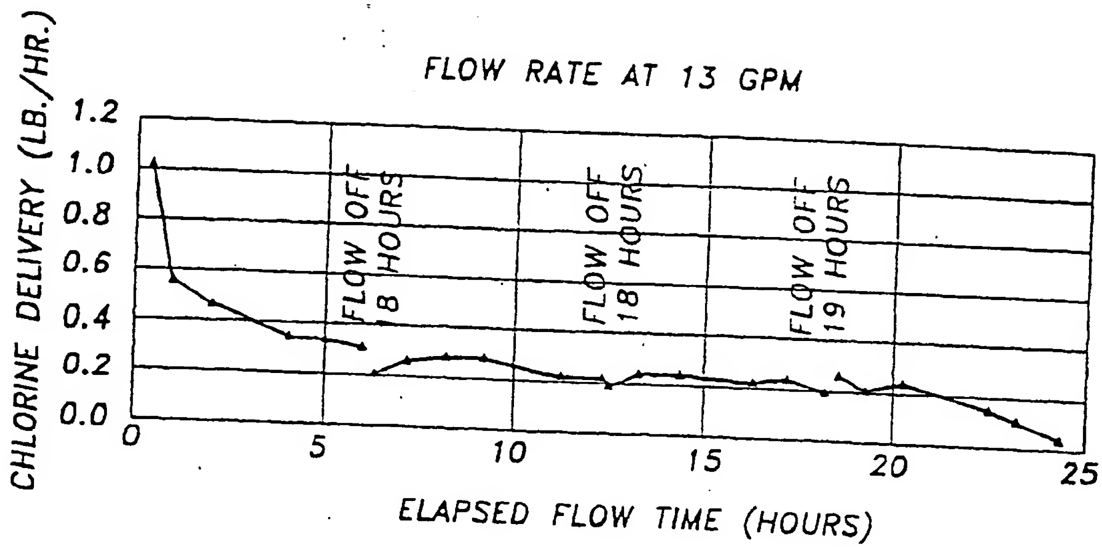

Figure 4a

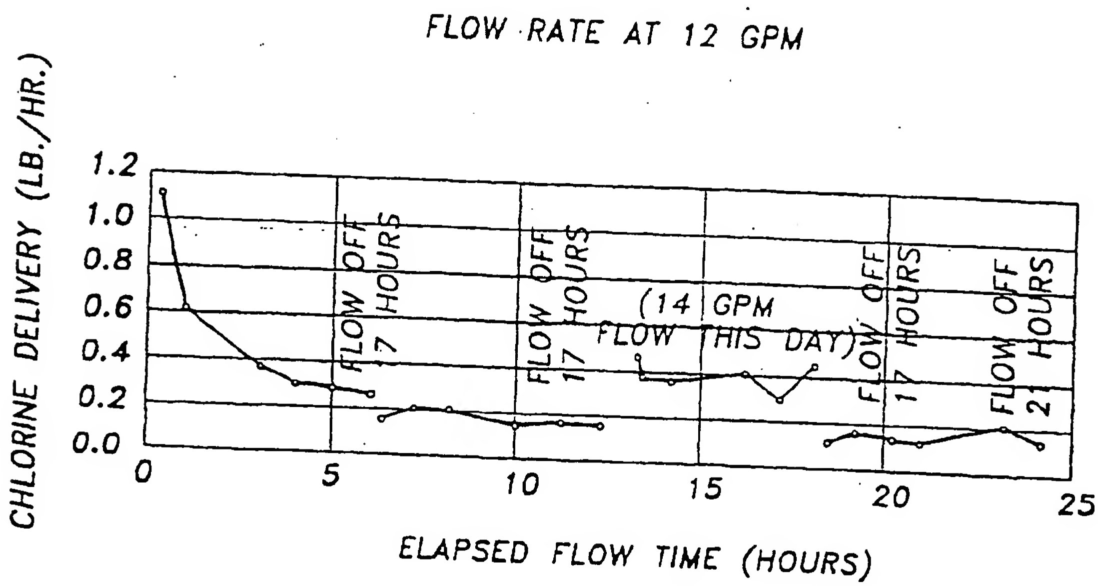

Figure 4b

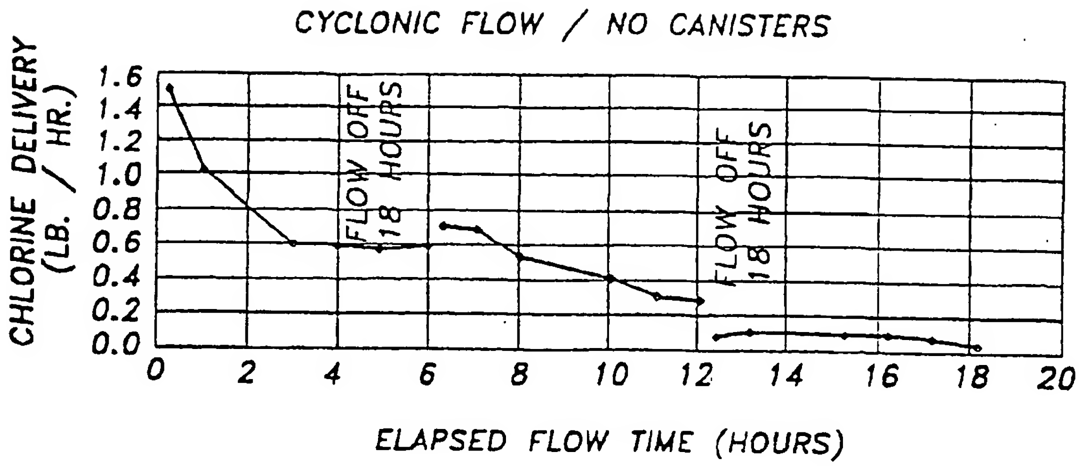

Figure 4c

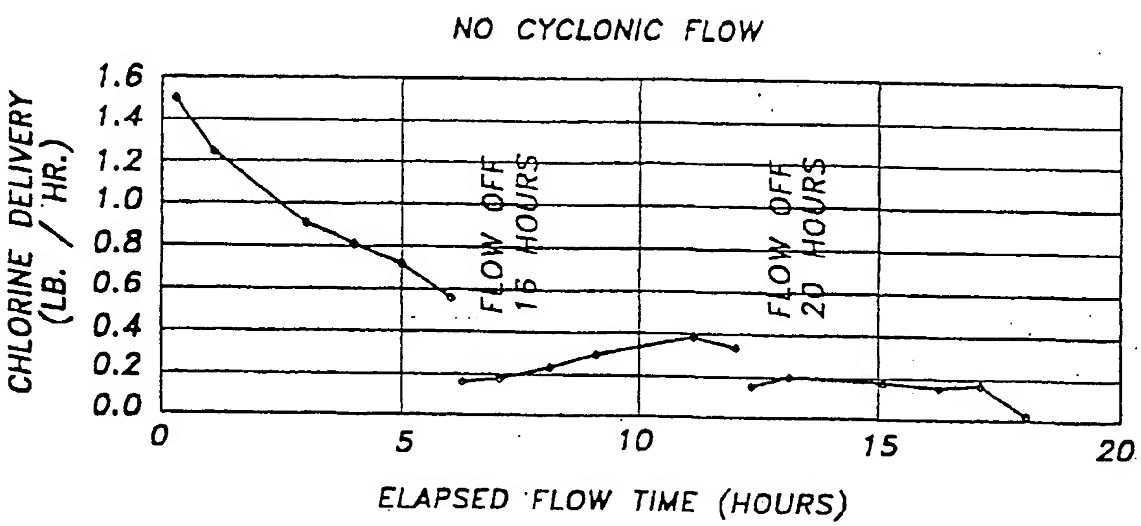

Figure 4d

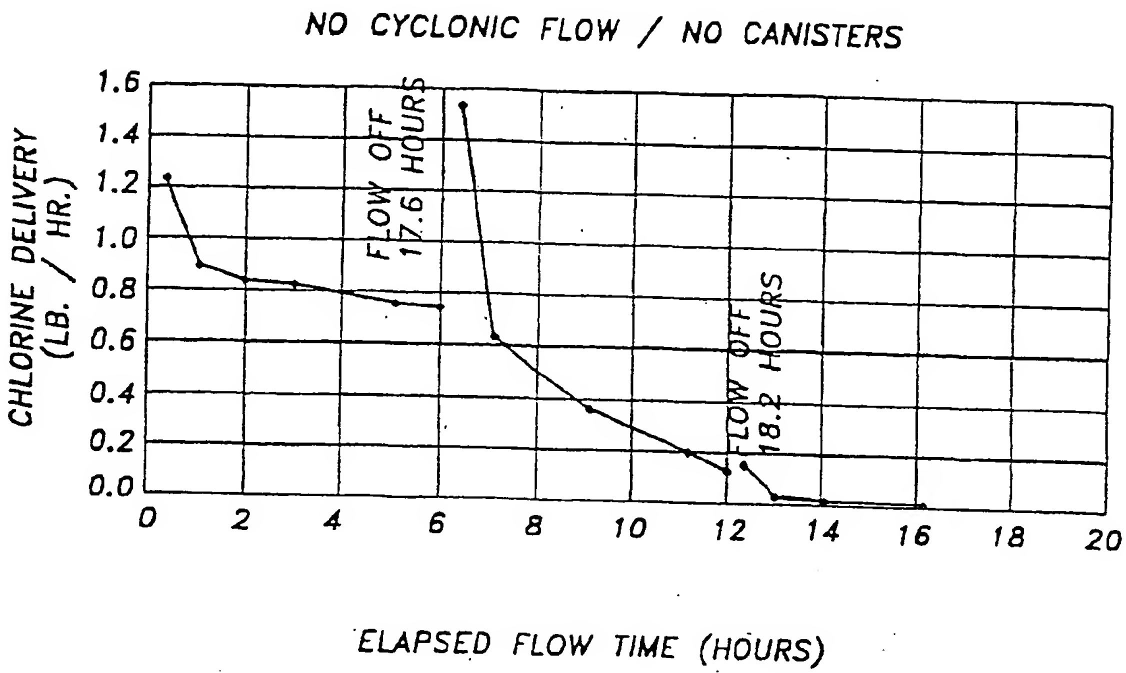
NO CYCLONIC FLOW / NO CANISTERS
CHLORINE DELIVERY (LB. / HR.)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
FLOW OFF 17.6 HOURS
FLOW OFF 18.2 HOURS
0
2
4
6
8
10
12
14
16
18
20
ELAPSED FLOW TIME (HOURS)

Figure 4e